Amendments to Claims

We claim:

1. (Original) Method of improving bodily safety of bystanders exposed to a monochromatic light source, comprising: providing a monochromatic light source with a distal end, causing said monochromatic light to diverge at said distal end, whereby at a first position of said distal end relative to a target the energy density of an exit beam from said distal end is substantially equal to the energy density of the monochromatic light and at a second position of the distal end relative to a target the energy density of the light emitted from said distal end is significantly less than the energy density of the monochromatic light.

2. (Original) Method of claim 1, further comprising

a) providing a diverging unit transparent to the monochromatic light unit comprising at least one focusing lens, a plurality of reflectors and a distally positioned plate transparent to the monochromatic light;

b) attaching said diverging unit to the distal end of the monochromatic light source;

c) focusing the monochromatic light onto at least one of said reflectors; and

d) allowing light rays to exit said plate at varying angles, depending on the number of times reflected by said reflectors, whereby to cause said monochromatic light to be divergent.

3. (Original) Method of claim 1, further comprising the steps of scattering the monochromatic light, said scattered monochromatic light being divergent.

4. (Original) Method of claim 3, further comprising:

a) providing a diffusing unit with a distal end, said diffusing unit comprising at least one diffusively transmitting element, wherein each of said diffusively transmitting elements is transparent to the monochromatic light;

b) attaching said diffusing unit to the distal end of the monochromatic light source; and

c) allowing the monochromatic light to be scattered by each of said diffusively transmitting elements.

5. (Original) Method of claim 3, further comprising:

a) providing a diffusing unit transparent to the monochromatic light comprising an angular beam expander and at least one diffuser;

b) attaching said diffusing unit to the distal end of the monochromatic light source; and

c) allowing the monochromatic light to propagate through said angular beam expander and said at least one diffuser, whereby to scatter said monochromatic light.

6. (Original) Method of claim 3, further comprising the following steps:

a) providing a diffusing unit with a plurality of diffusers, wherein at least one diffuser is axially displaceable;

b) axially displacing said at least one axially displaceable diffuser to an active position such that each diffuser is substantially in contact one with the other, whereby the energy density of an exit beam from said diffusing unit is substantially equal to the energy density of the monochromatic light at the first position of the distal end of the monochromatic light source; and

c) axially displacing said at least one axially displaceable diffuser to an inactive position such that each diffuser is separated one from the other by a gap large enough to generate a

sufficiently large scattering angle such that the energy density of the light emitted from said diffusing unit at the second position of the distal end of the monochromatic light source is significantly less than the energy density of the monochromatic light.

7. (Original) Method of claim 1, wherein the first position is substantially in contact with a target to which the monochromatic light is directed.

8. (Amended) Method of ~~any of~~ claim~~s~~ 1 ~~to 6~~, wherein the radiance of the divergent monochromatic light is less than 14 $J/cm^2/sr$.

9. (Amended) Method of ~~any of~~ claim~~s~~ 1 ~~to 6~~, wherein the radiance of the divergent monochromatic light is less than 10*k1*k2*(t^1/3) $J/cm^2/sr$, where t is a laser pulse duration in seconds, k1=k2=1 for a wavelength ranging from 400 to 700 nm, k1=1.25 and k2=1 for a wavelength of approximately 750 nm, k1=1.6 and k2=1 for a wavelength of approximately 810 nm, k1=3 and k2=1 for a wavelength of approximately 940 nm, and k1=5 and k2=1 for a wavelength ranging from 1060 to 1400 nm.

10. (Original) Method of claim 1, further comprising measuring the radiance of the divergent monochromatic light and issuing a warning as a result of a mishap if the radiance of the divergent monochromatic light is greater than a predetermined safe value.

11. (Original) Method of claim 1, wherein the monochromatic light is selected from the group of collimated laser beam, convergent laser beam, concentrated multiple laser beams and fiber guided laser beam.

12. (Original) Method of claim 11, wherein the monochromatic light source is selected from the group of

Excimer, Dye, Nd:YAG 1064, 1320 and 440 nm, frequency doubled Nd:YAG, Ruby, Alexandrite, Diode including diodes operating at a wavelength of 810 to 830 nm, 940nm, and 1450nm, stack of diodes, LICAF, Er:Glass, Er:YAG, Er:YSGG, CO_2, isotopic CO_2 and Holmium lasers.

13. (Original) Method of claim 1, wherein the monochromatic light is provided with a wavelength ranging from 308 to 1600 nm or between 1750 nm to 11.5 microns and the energy density level of the monochromatic light source ranges from 0.01 to 2000 J/cm^2.

14. (Original) Method of claim 1, wherein the monochromatic light source is a plurality of monochromatic diodes.

15. (Original) Method of claim 1, wherein the bodily safety includes eye safety, skin safety and environmental safety.

16. (Original) Method of claim 1, wherein the exit beam at the first position is used in applications selected from the group of cosmetic applications, medical applications and industrial applications.

17. (Original) Method of claim 1, wherein the exit beam at the first position is used in applications selected from the group of hair removal, coagulation of blood vessels located on a face or legs, treatment of rosacea, tattoo removal, removal of pigmented lesions in the skin, skin rejuvenation, treatment of psoriasis, treatment of acne, skin resurfacing, skin vaporization, collagen contraction, dental applications, removal of pigments from the gums, teeth whitening, dermatology, gynecology, podiatry, urology, reduction of pain, laser welding of transparent plastic materials, surface treating of materials, laser annealing, evaporation of paint and ink stains and cleaning of buildings, stones, antique sculptures and pottery.

18. (Original) Method of claim 4, wherein a laser beam is controllably repositionable to scan targets of the diffusively transmitting element.

19. (Original) Method of claim 18, wherein the sequence of targets to be impinged by the laser beam is programmable.

20. (Original) Method of claim 4, further comprising the following steps: providing the diffusing unit with a clear transmitting element such that a gap is formed between a diffusively transmitting element and said clear transmitting element, the diffusively transmitting and clear transmitting elements being transparent to the monochromatic light, placing said clear transmitting element on a target skin location, directing the monochromatic light to said target skin location and cooling skin within said gap.

21. (Original) Method of claim 1, wherein a half angle of a divergent exit beam at the first position exceeds 6 degrees.

22. (Original) Method of claim 4, wherein a half angle of a divergent exit beam at the first position exceeds 42 degrees.

23. (Original) Method of claim 1, wherein the duration of a laser pulse ranges from 1 nanosecond to 1500 msec, and the diameter of a spot size ranges from 1 to 20 mm.

24. (Original) Method of claim 23, wherein a series of pulses is generated.

25. (Original) Method for converting a laser unit suitable for aesthetic treatment, medical treatment or industrial treatment into an eye safe laser unit, comprising attaching a diverging optical unit to the distal end of a laser unit, allowing monochromatic light to propagate through said unit, generating a non-coherent and extended diffused source of

light from said unit at a sufficiently low radiance value such that said source of light is eye safe to bystanders exposed to a monochromatic light source and of a sufficiently high energy density at a treatment location to effect said aesthetic treatment, medical treatment or industrial treatment.

26. (Original) Method of claim 25, wherein the unit is a divergent diffusing optical unit.

27. (Original) Method of cooling skin which is irradiated with monochromatic light, comprising:

a) providing a monochromatic light source with a distal end;
b) providing a unit with two transmitting elements that are transparent to monochromatic light, such that a gap is formed between said two elements;
c) attaching said unit to the distal end of the monochromatic light source;
d) placing said unit on a skin location to be treated;
e) providing means for skin cooling, said skin cooling means being disposed within said gap;
f) allowing monochromatic light to propagate through said unit to said skin location, the temperature of the skin location to be treated thereby increasing; and
g) allowing said skin cooling means to cool said skin location.

28. (Original) Method of claim 27, further comprising the following steps:

a) providing the unit with a diffusively transmitting element and with a clear transmitting element distally positioned with respect to said diffusively transmitting element;
b) allowing the monochromatic light to be scattered by said diffusively transmitting element, whereby the energy density of

an exit beam from said clear transmitting element is substantially equal to the energy density of the monochromatic light; and

c) repositioning the unit from the target to a predetermined position at which the energy density of an exit beam from said diffusively transmitting element is significantly less than the energy density of the monochromatic light.

29. (Original) Method of claim 28, wherein the skin cooling means is fluid transparent to the monochromatic light, said fluid flowing through a conduit inserted within the gap.

30. (Original) Method of claim 29, wherein the fluid is in fluid communication with an external cooler.

31. (Amended) Method of claim 27 ~~or 28~~, wherein the skin cooling means is a thermoelectric cooler, the thermoelectric cooler operative to cool the lateral sides of the transmission element placed on the skin location to be treated.

32. (Original) Method of improving eye safety during exposure to a monochromatic light source, comprising: providing a monochromatic light source and generating a visible flash prior to the emission of a pulse of monochromatic light, thereby inducing an eye of a bystander to blink or to change its field of view in order to avoid staring at the monochromatic light.

33. (Original) Method of claim 32, wherein the generation of the visible flash is synchronized to the timing of the emission of the monochromatic light pulse.

34. (Original) Method of claim 33, wherein the duration of the pulse is shorter than an eye blinking response time.

35. (Original) Method of claim 34, wherein the monochromatic light source is suitable for hair removal, photorejuvenation or treatment of vascular lesions.

36. (Original) Apparatus for improving bodily safety of bystanders exposed to a monochromatic light source, comprising a means attached to the distal end of a monochromatic light source, said means adapted to cause the monochromatic light to be divergent, whereby at a first position of said distal end relative to a target the energy density of an exit beam from said distal end is substantially equal to the energy density of the monochromatic light and at a second position of said distal end relative to a target the energy density of the light emitted from said distal end is significantly less than the energy density of the monochromatic light.

37. (Original) Apparatus of claim 36, wherein the diverging means comprises a diverging unit provided with at least one focusing lens, a plurality of reflectors and a distally positioned plate transparent to the monochromatic light, each of said at least one lens provided with a suitable focal length so as to focus the monochromatic light onto at least one of said reflectors, each of said reflectors positioned so as to allow light rays to exit said plate at varying angles, depending on the number of times reflected by said plurality of reflectors, whereby to cause said monochromatic light to be divergent.

38. (Original) Apparatus of claim 36, wherein the diverging means is also a scattering means.

39. (Original) Apparatus of claim 38, wherein the scattering means comprises a diffusing unit attachable to the distal end of the monochromatic light source, said diffusing unit including at least one diffusively transmitting element that is transparent to essentially coherent monochromatic light.

40. (Original) Apparatus of claim 38, wherein the scattering means comprises a diffusing unit attachable to the distal end of the monochromatic light source, said diffusing unit including an angular beam expander and at least one diffuser.

41. (Original) Apparatus of claim 38, wherein the scattering means comprises a diffusing unit attachable to the distal end of the monochromatic light source, said diffusing unit comprising a plurality of diffusers wherein at least one is axially displaceable, such that at an active position the plurality of diffusers are substantially in contact one with the other at the first position of the distal end of the monochromatic light source, and the energy density of an exit beam from said diffusing unit is substantially equal to the energy density of the monochromatic light, and at an inactive position each of said diffusers is separated one from the other by a gap such that the energy density of the light emitted from the diffusing unit is significantly less than the energy density of the monochromatic light at the second position of the distal end of the diffusing unit.

42. (Original) Apparatus of claim 36, wherein the first position is substantially in contact with a target to which the monochromatic light is directed.

43. (Amended) Apparatus of ~~any of~~ claim~~s~~ 36 ~~to 41~~, wherein the radiance of the divergent monochromatic light is less than 14 $J/cm^2/sr$.

44. (Amended) Apparatus of ~~any of~~ claim~~s~~ 36 ~~to 41~~, wherein the radiance of the divergent monochromatic light is less than 10*k1*k2*(t^1/3) $J/cm^2/sr$, where t is a laser pulse duration in seconds, k1=k2=1 for a wavelength ranging from 400 to 700 nm,

k1=1.25 and k2=1 for a wavelength of approximately 750 nm, k1=1.6 and k2=1 for a wavelength of approximately 810 nm, k1=3 and k2=1 for a wavelength of approximately 940 nm, and k1=5 and k2=1 for a wavelength ranging from 1060 to 1400 nm.

45. (Original) Apparatus of claim 36, wherein the monochromatic light is selected from the group of collimated laser beam, convergent laser beam, concentrated multiple laser beams and fiber guided laser beam.

46. (Original) Apparatus of claim 45, wherein the monochromatic light source is selected from the group of Excimer, Dye, Nd:YAG 1064, 1320 and 1440 nm, frequency doubled Nd:YAG, Ruby, Alexandrite, Diode including diodes operating at a wavelength of 810 to 830 nm, 940nm, and 1450nm, stack of diodes, LICAF, Er:Glass, Er:YAG, Er:YSGG, CO_2, isotopic CO_2 and Holmium laser units.

47. (Original) Apparatus of claim 36, wherein the monochromatic light is provided with a wavelength ranging from 308 to 1600 nm or between 1750 nm to 11.5 microns and the energy density level of the monochromatic light source ranges from 0.01 to 2000 J/cm^2.

48. (Original) Apparatus of claim 36, wherein the monochromatic light source is a plurality of monochromatic diodes.

49. (Original) Apparatus of claim 36, wherein the bodily safety includes eye safety, skin safety and environmental safety.

50. (Original) Apparatus of claim 36, wherein the exit beam at the first position is used in applications selected from the group of cosmetic applications, medical applications and industrial applications.

51. (Original) Apparatus of claim 36, wherein the exit beam at the first position is used in applications selected from the group of hair removal, coagulation of blood vessels located on a face or legs, treatment of rosacea, tattoo removal, removal of pigmented lesions in the skin, skin rejuvenation, treatment of psoriasis, treatment of acne, skin resurfacing, skin vaporization, collagen contraction, dental applications, removal of pigments from the gums, teeth whitening, dermatology, gynecology, podiatry, urology, reduction of pain, laser welding of transparent plastic materials, surface treating of materials, laser annealing, evaporation of paint and ink stains and cleaning of buildings, stones, antique sculptures and pottery.

52. (Original) Apparatus of claim 45, wherein the duration of a laser pulse ranges from 1 nanosecond to 1500 msec.

53. (Original) Apparatus of claim 46, wherein the laser unit is provided with a power level ranging from 1 to 2000 W, when under continuously working operation.

54. (Original) Apparatus of claim 39, wherein the material of each diffusively transmitting element is selected from the group of silica, glass, sapphire, diamond, non-absorbing polymer, light diffusing polymer, polycarbonate, acrylic, densely packed fibers, NaCl, CaF_2, glass, ZnSe and BaF_2.

55. (Original) Apparatus of claim 39, wherein the diffusing unit is further provided with a clear transmitting element distal to a diffusively transmitting element, the diffusively transmitting element and clear transmitting elements being mutually parallel and perpendicular to the longitudinal axis of the diffusing unit.

56. (Original) Apparatus of claim 55, wherein the clear transmitting element is made of a material selected from the

group of glass, sapphire, transparent polymer including polycarbonate and acrylic, BaF_2, NaCl and ZnF_2.

57. (Original) Apparatus of claim 55, wherein a gap between the diffusively transmitting and clear transmitting elements is less than 2 mm.

58. (Original) Apparatus of claim 39, wherein each diffusively transmitting element is provided with a plurality of irregularities which are randomly distributed thereabout.

59. (Original) Apparatus of claim 39, wherein the diffusively transmitting element is formed by a diffraction pattern or by a randomly distributed array of thin fibers.

60. (Original) Apparatus of claim 40, wherein the diffusing unit further comprises at least one light guide, each of said light guides being provided with internally reflecting walls and an exit surface.

61. (Original) Apparatus of claim 60, wherein a light guide is tapered.

62. (Original) Apparatus of claim 60, wherein a light guide is made of a material selected from the group of solid glass, sapphire, plastic and liquid dielectric material.

63. (Original) Apparatus of claim 60, further comprising an optical element which increases the divergence angle of monochromatic light and a diffuser which receives light from said optical element and emits said received light to the light guide, the exit surface of said light guide functioning as a wide angle extended diffuser source.

64. (Original) Apparatus of claim 39, further comprising a plurality of reflectors, the angular disposition and distance of each reflector relative to the diffusing unit

being repositionable, whereby to accurately direct the monochromatic light to a selected target on the diffusively transmitting element.

65. (Original) Apparatus of claim 64, further comprising a processor, said processor suitable for the programming of the sequence of targets to be impinged by the monochromatic light.

66. (Original) Apparatus of claim 39, further comprising a scanner for rapid repositioning of the monochromatic light to a target on the diffusively transmitting element.

67. (Original) Apparatus of claim 36, wherein the distance between a distal end of the diverging means and the target at the first position of the distal end of the monochromatic light source is the smaller of 2 mm and the diameter of the monochromatic light.

68. (Amended) Apparatus of ~~any of~~ claim~~s~~ 37 ~~to 41~~, wherein a unit is attached to the distal end of the monochromatic light source by an attachment means.

69. (Original) Apparatus of claim 68, wherein the unit is fixedly attached to the distal end of the monochromatic light source.

70. (Original) Apparatus of claim 68, wherein the unit is integrally formed together with the distal end of the monochromatic light source during manufacturing, the unit being disposed internally to the outer wall of the monochromatic light source.

71. (Original) Apparatus of claim 68, wherein the attachment means is releasable.

72. (Original) Apparatus of claim 71, wherein the

attachment means is permanently attached to the monochromatic light source and displaceable, whereby in one position of a displaceable unit the monochromatic light source is coherent, not propagating through said displaceable unit, and in a second position at which said displaceable unit is attached to the distal end of the monochromatic light source, the monochromatic light is noncoherent, propagating through the displaceable unit.

73. (Original) Apparatus of claim 36, wherein a divergent angle of the divergent monochromatic light is greater than a half angle of 6 degrees.

74. (Original) Apparatus of claim 39, wherein a half angle of a scattered exit beam exceeds 42 degrees.

75. (Amended) Apparatus of claim~~s~~ 37 ~~to 41~~, further comprising a means to evacuate vapors or particles from a target to thereby prevent a change in optical properties of the unit.

76. (Original) Apparatus of claim 75, wherein the evacuation means is U-shaped in vertical cross-transmission element, to allow for contact with a target at its lateral ends and for evacuation of vapors or particles through a gap formed by its central open region.

77. (Original) Apparatus of claim 75, the evacuation means further comprising a relay optics device, whereby to concentrate the exit beam from the unit onto the target.

78. (Original) Apparatus of claim 55, further comprising a means for skin cooling, said skin cooling means being disposed in a gap formed between the frosted and clear transmitting elements.

79. (Original) Apparatus of claim 36, further comprising a means for measuring the radiance of the divergent monochromatic

light, control circuitry in communication with said measuring means and the monochromatic light source, and a warning means in communication with said control circuitry which is activated, as a result of a mishap, if the radiance of the divergent monochromatic light is greater than a predetermined safe value.

80. (Original) Apparatus of claim 36, further comprising a means for generating a visible flash and control circuitry in communication with said means for generating a visible flash and with the monochromatic light source, said control circuitry synchronized such that a flash is generated prior to the emission of each pulse of monochromatic light.

81. (Original) Apparatus of claim 36, wherein the monochromatic light source is one or more arrays of a diode light source.

82. (Original) Apparatus for cooling skin which is irradiated with monochromatic light, comprising:

a) a monochromatic light source with a distal end;

b) a unit attachable to the distal end of the monochromatic light source, said unit being provided with two elements that are transparent to monochromatic light, such that a gap is formed between said two elements; and

c) a means for skin cooling insertable within said gap, said skin cooling means adapted to reduce the rate of increase of temperature at a target skin location.

83. (Original) Apparatus of claim 82, wherein one element is a diffusively transmitting element and the other element is a clear transmitting element distally positioned with respect to

said diffusively transmitting element, whereby the energy density of an exit beam from the diffusing unit is substantially equal to the energy density of the monochromatic light upon placement of the diffusing unit at a position adjacent to a target skin location and is significantly less than the energy density of the monochromatic light at a distance from said target.

84. (Original) Apparatus of claim 82, wherein the skin cooling means is a fluid transparent to said monochromatic light, said fluid flowable through a conduit inserted within the gap.

85. (Original) Apparatus of claim 84, wherein the fluid is in fluid communication with an external cooler.

86. (Original) Apparatus of claim 84, wherein the fluid is a liquid or a gas.

87. (Amended) Apparatus of claim 82 ~~or 83~~, wherein the skin cooling means is a thermoelectric cooler, the thermoelectric cooler operative to cool the lateral sides of the element placed adjacent to the skin location to be treated.

88. (Amended) Apparatus of ~~any of~~ claim~~s~~ 82 ~~to 87~~, further comprising a scanner, said scanner being adapted to rapidly reposition the monochromatic light to a target on the diffusively transmitting element, the skin cooling means capable of continuously cooling the skin at a corresponding target skin location.

89. (Original) Apparatus for improving eye safety during exposure to a monochromatic light source, comprising: a monochromatic light source, a means for generating a visible flash prior to emission of a monochromatic light, and control

circuitry in communication with said means for generating a visible flash.

90. (Original) Apparatus of claim 89, wherein the control circuitry is synchronized such that the flash is generated prior to the emission of each pulse of monochromatic light, thereby inducing an eye of a bystander to blink or to change its field of view in order to avoid staring at the monochromatic light.

91. (Original) Apparatus of claim 90, wherein the duration of the pulse is shorter than an eye blinking response time.

92. (Original) Apparatus of claim 89, wherein the monochromatic light source is suitable for hair removal, photorejuvenation or treatment of vascular lesions.